

REVIEW OF ASTEC

AN EVALUATION OF THE AUSTRALIAN SCIENCE AND TECHNOLOGY COUNCIL

ASTEC REVIEW COMMITTEE

October 1992

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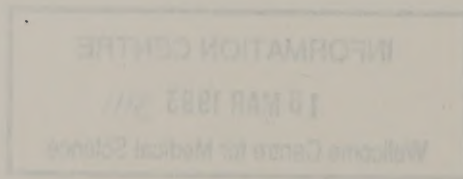
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ASTEC REVIEW COMMITTEE

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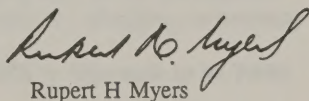
Dear Minister

We, the members of the committee you appointed on 28 April 1992 to conduct an evaluation of the Australian Science and Technology Council, have completed our task and have the honour of submitting herewith our report.

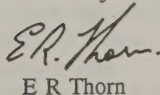
We feel we should draw your attention to the fact that during the course of our study we received some submissions suggesting that the entire science and technology policy advisory machinery be reviewed. While we have not done this - the review has been carried out in accordance with the terms of reference you set down for us - we have been mindful, in our evaluation and reporting, of the wider context in which ASTEC currently operates.

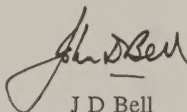
We have been greatly assisted in our task by and are most grateful to the present and former members of ASTEC and the many other organisations and individuals who have made submissions and have given valuable information and advice. We commend especially to your attention the excellent service rendered to us by our secretary, Mr John Madden, to whom we owe our warmest thanks.

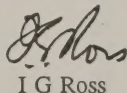
Yours sincerely

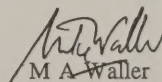

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REVIEW OF ASTEC

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GLOSSARY OF ACRONYMS

ASTEC	Australian Science and Technology Council
BMR	Bureau of Mineral Resources
CRP	Centre for Research Policy
CSIRO	Commonwealth Scientific and Industrial Research Organization, Australia
DSTO	Defence Science and Technology Organisation, Australia
NISTEP	National Institute for Science, Technology and Engineering Policy, Japan
NSF	National Science Foundation, United States of America
OSTP	Office of Science and Technology Policy, United States of America
PMSC	Prime Minister's Science Council
PMSEC	Prime Minister's Science and Engineering Council
R&D	Research and development
S&T	Science and technology
TCC	Technological Change Committee (a former standing committee of ASTEC)

EXECUTIVE SUMMARY

Purpose and scope of the review

S.1 The Australian Science and Technology Council (ASTEC) was established as a statutory authority reporting to the Prime Minister in 1978. This is the first comprehensive review of its operation. The Review Committee was asked to evaluate ASTEC's objectives, performance and outcomes in the context of the provisions of ASTEC's Act and to recommend actions to improve ASTEC's performance and effectiveness. The Committee consulted widely with those concerned with the past and future of ASTEC. This report represents the conclusions reached by the Committee as a result of its extensive deliberations.

S.2 ASTEC's purpose is to provide independent advice on a range of matters concerning science and technology including but not limited to the advancement of knowledge, the identification and support of new ideas, the practical development and application of discoveries, the use of science and technology to improve efficiency in the use of resources and the fostering of innovation in industry. The environment in which ASTEC now operates is changed significantly from that at its inception. Towards the end of the 1980s alternative governmental sources of advice came into being - science advisers in departments, the Chief Scientist and his Office, the Coordinating Committee on Science and Technology and the Prime Minister's Science Council. This has led to a questioning of the role of ASTEC. The Review Committee, however, has no hesitation in endorsing the role assigned to ASTEC in its Act. Nevertheless we feel that ASTEC has lost some of its initial drive, has become rather set in its ways and needs to become more enterprising and imaginative in tackling its tasks.

S.3 In summary the conclusions and recommendations of the Review Committee are-

- **ASTEC should continue as a separate organisation with its present functions**
- **ASTEC itself needs to appreciate and come to terms with its distinctive role**
- **ASTEC's capacity to carry out that role needs to be strengthened**
- **ASTEC should implement, after review, a series of measures to enhance its effectiveness.**

S.4 The Review Committee considers that the role which was legislated for ASTEC in 1978 is still valid today. The core of this role is to provide information and advice on broad and strategic issues concerning science and technology. This involves looking across the whole field of science and technology to identify opportunities and difficulties that need to be addressed. ASTEC is well placed to undertake this work because of its

broad based membership and because it stands outside executive government. No other science advisory body is as well suited to undertake this core role.

S.5 The Review Committee considers that ASTEC and the other science advisory agencies, in particular the Office of the Chief Scientist and the Prime Minister's Science and Engineering Council, are essentially complementary. ASTEC's distinctive feature is the contribution it can make to the more strategic and often longer term issues. ASTEC can also assist on more immediate issues but this is not its essential function.

RECOMMENDATION 1

ASTEC should be retained as a separate statutory body.

- 1a There is no need to change ASTEC's enabling legislation.*
- 1b There is no need to change ASTEC's functions as set out in its Act.*
- 1c ASTEC should continue to report to the Prime Minister.*

S.6 The Review Committee then looked at how ASTEC operates and how it could operate better. The Committee believes that the following should be considered in the formulation of ASTEC's future strategy -

- a strong focus on the consultative role;
- emphasis on the provision of consolidated views of the science, technology and related industrial communities to government;
- a focus on the longer term issues of direct relevance to government;
- greater emphasis on assessment of the effectiveness of S&T spending by government, leading to the formulation of reallocation strategies;
- development of longer term visions of the threats, opportunities and likely scenarios for the development of science and technology; and the policy responses necessary for the government to make (ie shaping the S&T policy agenda); and
- articulation of the future directions of science, technology and innovation so that efficient adjustment patterns may be charted.

S.7 ASTEC itself needs to have a clear view of its distinctive role and needs to translate this into a program of work. The Corporate Plan is a means to this end. The Review Committee found that there is little commitment from ASTEC or its staff to the existing 1990-92 Corporate Plan. ASTEC therefore needs to go through the process of reworking its Corporate Plan to provide, after wide consultation, a clear understanding of its role, its "stakeholders" and the priorities and strategies that it needs to adopt.

RECOMMENDATION 2

ASTEC needs to develop a clear appreciation of its role and translate this into objectives, strategies and activities.

S.8 The Review Committee considers that ASTEC's capacity to undertake its work can be improved.

S.9 We consider that if ASTEC is to operate effectively as a deliberative body then the full complement of members allowed under its Act, fifteen, should be appointed. In selecting members only persons closely involved in providing policy advice to the Commonwealth Government should be considered ineligible. ASTEC would benefit from a higher proportion of members having an industry background. Ideally the people to be attracted are those senior managers just below chief executive officer rank who have experience in the transfer and application of technology.

RECOMMENDATION 3

ASTEC's capacity to carry out its role needs to be strengthened.

3a *ASTEC should appoint the full complement of fifteen members of whom no fewer than five should have industry backgrounds.*

S.10 The Review Committee concluded that ASTEC should consider a number of measures which will each offer some prospect of enhancing ASTEC's efficiency and effectiveness.

Identification of relevant issues

S.11 The Commonwealth Government needs a source of new ideas and an early warning of difficulties on the horizon. Attention should be given to current awareness or scanning activities in order to ensure that ASTEC is properly briefed on new developments in S&T policy and policy-related research. In appropriate instances ASTEC should prepare brief outline papers for the government.

S.12 ASTEC's work has been heavily skewed towards science at the expense of technology and, within science, there has been some emphasis on the physical sciences at the expense of the biological and health sciences. A more balanced approach to its functions is required with greater emphasis on issues concerning the application of science and technology particularly in industrial contexts.

Procedures

S.13 ASTEC is not an implementing body. To be effective ASTEC needs to convince others, both inside and outside government, of the correctness and significance of its views. ASTEC can enhance its capability in this regard by identifying, at the planning stage, those amongst the stakeholders who have a role to play in the follow through on a report, with a view to consulting with them and keeping them informed. Further attention also needs to be paid to:

- (i) the process of determining ASTEC's work program including consultation at a senior level with the government; and justification in its annual report of the issues selected;
- (ii) detailed examination by the Council of the issues raised in draft reports so that the final result truly reflects the considered views of the Council; and
- (iii) the means by which ASTEC promotes its views.

Roles of the Chairman and the Secretary

S.14 The Chairman needs to have a strong view of ASTEC's mission, the relative emphasis to be given to each statutory function and what should be achieved in a five year term. The Chairman needs to be in continuing liaison with senior individuals involved in science and technology and related policy. The Secretary of ASTEC provides a crucial link between the government and the Council by facilitating a two way flow of information on the timing, relevance and significance of policy proposals and actions. The Deputy Chairman, too, can assist in some of these tasks.

Structures

S.15 With a full time secretariat and a part time Council ASTEC has to rely on the members of the Council to supervise and direct the Council's activities. The major responsibility for steering the process and exercising quality control rests with the Chairman. We consider that regular monthly meetings during most of the year are essential and provide the opportunity for deliberation and interaction, as well as reporting, control and direction. Every ASTEC report is drafted under the direction of a working party of ASTEC members and, of late, external experts. We consider this to be a most effective mechanism which should be continued. More flexibility is required, however, in the gathering of inputs to the studies.

Management of the Secretariat

S.16 We specifically considered the option of amalgamating the Office of ASTEC with the Office of the Chief Scientist. The Committee is strongly of the view that ASTEC must have control over its own resources. Whether those funds are to be used to pay

salaries etc for staff directly under ASTEC's control, or to buy in the required services, should be determined by ASTEC itself. The Council's response to this Review provides an opportunity to review current arrangements (including the size of the "permanent" secretariat) and establish an enhanced management culture.

Working arrangements with the PMSEC

S.17 We believe that the distinctive roles of ASTEC and PMSEC need to be better explained to the community. We firmly believe that the two bodies should not be merged. Also a more interactive working relationship between the Office of ASTEC and the Office of the Chief Scientist would be beneficial. Consistent with ASTEC's role there may be times when the Council can be used to prepare or contribute to PMSEC papers.

Resources

S.18 In its submission to the Review ASTEC argued for a larger budget. Clearly a larger budget would allow ASTEC to do more but the Review Committee is satisfied that ASTEC can discharge its core role within the current level of its budget.

RECOMMENDATION 4

ASTEC should implement, after review, a series of measures to improve its effectiveness.

CHAPTER ONE

Purpose and Scope of the Review

Origins of the Review

1.1 The Australian Science and Technology Council (ASTEC) is a permanent Commonwealth Government agency and for administrative purposes it is deemed to be a program in the Prime Minister and Cabinet portfolio. Each Commonwealth Government program is evaluated on a regular basis to assess its effectiveness and efficiency in the use of resources, its performance against objectives, and whether it represents the most appropriate way to achieve a desired goal.

1.2 The Minister for Science and Technology and Minister Assisting the Prime Minister, the Hon. Ross Free, MP, appointed the Review Committee to conduct the program evaluation of ASTEC within specific terms of reference (see Box A). The Minister announced the Review of ASTEC on 28 April 1992.

Interpretations of the Scope of the Review

1.3 The Review of ASTEC is an evaluation of a government policy advising program. Regular and systematic assessments of this kind provide the basis for ensuring that those providing advice, which can have a substantial and sometimes decisive role in shaping government policy decisions, are held accountable for their work. The assessments allow the Parliament and the community to have assurances about the quality of the work and whether it meets fully the required standards of rigour, integrity, relevance and timeliness.

1.4 The Review provides an opportunity (i) to examine the performance of ASTEC in fulfilling its statutory functions and (ii) to assess the effectiveness of its various activities and their value to the government. The Review Committee's terms of reference do not authorise a wider ranging study of all of the science and technology policy advisory mechanisms established by the Commonwealth Government but the Committee in its evaluation and reporting has been mindful of the broader policy context in which ASTEC operates.

Methodology of the Review

1.5 In announcing the Review in a media statement, the Minister for Science and Technology noted that the Review Committee would welcome submissions. The Committee identified some 180 organisations and individuals which it considered could have useful perceptions on the performance and effectiveness of ASTEC and wrote to them asking for submissions. Over 90 submissions were received. The Committee

commissioned consultants to examine the process and outcomes of four selected ASTEC reports and the consultants interviewed some 45 individuals involved with the reports. The Committee itself interviewed more than 30 individuals associated with ASTEC, with Commonwealth and State departments and agencies or with the science, technology and business communities. In addition, the Committee held two joint meetings with the Australian Science and Technology Council.

1.6 The Committee had due regard for the science and technology policy advisory arrangements in other countries and drew insights from these arrangements in coming to its conclusions.

ASTEC REVIEW

TERMS OF REFERENCE

The primary purpose of the Review is to provide a basis for improving the performance of ASTEC. This is to be achieved by an evaluation of ASTEC's objectives, performance and outcomes in the context of the provisions of the Australian Science and Technology Council Act 1978.

The Review Committee will conduct the evaluation and recommend actions to improve ASTEC's performance and effectiveness, with special reference to:

1. The contribution which ASTEC's mission and goals, as set out in its 1990-92 Corporate Plan, make to the achievement of its statutory responsibilities; and whether these missions and goals need to be modified.
2. The effectiveness of ASTEC's activities in:
 - (a) identifying significant science, technology and related issues which are relevant to the conduct of science and technology and/or to Australia's social and economic development;
 - (b) investigating science, technology and related issues, and providing advice on them to the Prime Minister and the Government; and
 - (c) providing information and analysis which assist in the development of Government policies involving or related to science and technology.
3. The impact on Government of ASTEC's activities in these areas.
4. The adequacy and effective use of resources, structures and procedures to meet ASTEC's statutory responsibilities.

CHAPTER TWO

ASTEC's Establishment and Purpose

History of ASTEC

2.1 ASTEC was established in April 1977 and became a statutory authority in February 1979 reporting to the Prime Minister. It has had four Chairmen in 15 years - Sir Geoffrey Badger, Professor Ralph Slatyer, Professor Ray Martin and since April 1992 Professor Michael Birt. Over that period, the style and influence of ASTEC has changed. In part this is a result of changes in the structures and responsibilities of other agencies and portfolios; of the increasing complexity of the issues involving science and technology which come before the Commonwealth Government; and of the approach of the Chairmen. An historical overview of ASTEC forms an Appendix to ASTEC's submission to the Review which is available as an ASTEC Occasional Paper.[1]

Rationale for ASTEC's Establishment

2.2 In the Second Reading speech [2] to establish ASTEC as a permanent statutory body the then Prime Minister, Mr Fraser, said that this would ensure that the government would have available to it, on a continuing basis, independent advice of the highest calibre on matters of science and technology. He also stated:

"The history of science policy advisory bodies in Australia has been chequered. It is important that ASTEC is constituted as a statutory body in order to provide the Council with the status, permanence and stability it needs to do its job effectively. It is also important to ensure that ASTEC be as independent as possible of any department of Government, and statutory status is necessary to achieve this. The Council will report to the Prime Minister - an administrative arrangement reflecting both the status and independence of ASTEC..."

"[ASTEC's] functions will allow the Council a very wide charter indeed. It can range from pure science, to the problems of improving efficiency in industry by applying the results of research and development. It can consider the activities and technological problems of higher education institutions and private enterprise. The Government believes that this wide overview will allow ASTEC to play an important part in ensuring that there is a worthwhile interchange of ideas, information and new discoveries between Government, industry and academic science and scientists."

"The Council's advice to the Government on priorities and balance of effort will inevitably influence the allocation of resources by the Government and facilitate long term, well conceived forward planning by both government and industry. In

keeping with the quality of advice which the Council is to provide, only people of the highest quality and standing will be appointed as members. A proportion of the membership will have backgrounds in various sectors of industry and others will have academic backgrounds. People having a high contribution to make by virtue of special knowledge and experience can also be appointed. Members will be selected for their personal qualities rather than as representatives of organisations or interests."

2.3 The Prime Minister noted that the legislation provided ASTEC with sufficiently wide powers to enable it to execute its functions and with the necessary independence to enable it to undertake its functions effectively and so that its advice could be provided to government freely and without unwarranted influence. He concluded by saying that the government believed that *"there was an overwhelming case for establishing an effective science advisory body in Australia which is an independent and permanent statutory authority. Nothing less will properly safeguard the status, permanence and stability of ASTEC."*

Functions, Missions and Goals

2.4 In its Act, ASTEC is charged with providing information and advice on seven matters relating to science and technology:

1. The advancement of scientific knowledge.
2. The development and application of science and technology in relation to the furtherance of the national well-being.
3. The adequacy, effectiveness and overall balance of scientific and technological activities in Australia.
4. The identification and support of new ideas in science and technology likely to be of national importance.
5. The practical development and application of scientific discoveries.
6. The fostering of scientific and technological innovation in industry.
7. The means of improving efficiency in the use of resources by the application of science and technology.

2.5 An analysis of the functions covered by ASTEC reports over the past ten years is given in Table 2.1. The information it contains was provided by ASTEC at the Committee's request. It is evident that over this period the science based functions (1, 2 and 3) were given a great deal of emphasis. In contrast, particularly over the past five years, the technology transfer and innovation functions have in fact received little attention; and, in comparison with the other functions, the identification and support of new ideas in S&T has been the lowest priority for ASTEC.

2.6 In various documents [3], ASTEC has stated its mission, goals, objectives, strategies and performance criteria. Like the first versions of most documents of this kind the ASTEC Corporate Plan, 1990-92, was somewhat diffuse. ASTEC itself appears to accept that the Plan does not provide a strong sense of direction for the Council and its secretariat. We return to this matter later in the report (see paragraph 7.11).

References

- [1] ASTEC Submission to the Review of ASTEC, ASTEC Occasional Paper No.22, AGPS, Canberra, 1992
- [2] House of Representatives Hansard, 13 April 1978, pp 1502-1504
- [3] ASTEC Corporate Plan, 1990-92; Prime Minister and Cabinet Portfolio Performance Statements for 1991 and 1992

Table 2.1

Principal Functional Themes Covered by ASTEC Reports, 1983-1992

Note: The numbers in this table refer to the numbered functions set out on page 6

REPORT	FUNCTIONS COVERED
1983	
Incentives for Innovation in Australian Industries	2,6,7
Technological Change and Employment	2,7
Videotex in Australia-Interactive Information Services	4
Operation of National Research Granting Schemes	1,2,3
1984	
Guidelines for the Operation of National Research Facilities	1,3
Technology and Handicapped People	2
Australia's Role in the Nuclear Fuel Cycle	2,5,7
Australia's Broad Spectrum Bilateral S&T Agreements	1,2,3
Government Purchasing and Offsets Policies in Industrial Innovation	6,7
1985	
Computer Related Technologies in the Metal Trades Industry	4,5,6
Nuclear Science and Technology in Australia	1,3,5
Public Investment in R&D in Australia	1,2,3
Future Directions for CSIRO	2,5,6,7
1986	
Telecommunications R&D	2,5,6
New Office Technology	4,6
Mechanisms for Technology Transfer into Australia	2,4,5,6
Towards a Cashless Society?	4
The Defence Science and Technology Organisation and National Objectives	2,5,6,7

1987

Improving the Research Performance of Australia's Universities	1,2,3
After the Harvest: Opportunities and Technologies in Horticulture	5,6
Computerised Assistants: New Tools for Society	4,5,6
Improving Australia's Competitiveness Through Industrial R&D	6
The Advanced Facility at the National Acoustic Laboratories	3
Wealth from Skills: Measures to Raise the Skills of the Workforce	2,7

1988

Casting the Net: Post Harvest Technologies and Opportunities in the Fishing Industry	5,6
---	-----

1989

Health, Politics, Trade: Controlling Chemical Residues in Agricultural Products	7
The Core Capacity of Australian Science and Technology	1,2,3,6
The Future of Australian Astronomy	1,3
Profile of Australian Science	1,2,3

1990

Science, Technology and Australia's Future	2,6,7
Small Country, Big Science: Australian Participation in Major International Accelerator and Beam Facilities	1,3
Your Word is My Command	4,5
Environmental Research in Australia	1,2,3
Setting Directions for Australian Research	3
Government Funding of Academic and Related Research in Australia	3

1991

An Australian International Gravitational Observatory	1,3
Research and Technology: Future Directions	2,3,6,7

1992

Major National Research Facilities: A National Program	1,3
--	-----

CHAPTER THREE

Structures, Procedures and Resources

Structures and Procedures

3.1 The Council consists of a Chairman, a Deputy Chairman and a maximum of thirteen members each of whom is a part-time appointment although the Act provides for the Chairman and Deputy Chairman to be full-time or part-time appointments. Appendix B of ASTEC's submission lists the current membership. The Council reports to the Prime Minister but, since early 1992, this has been through the Minister for Science and Technology in his role as Minister Assisting the Prime Minister.

3.2 ASTEC conducts investigations and produces reports, papers, briefings and memorandums for the Prime Minister in response to requests from the government or based on its judgement of the issues warranting its attention.

3.3 ASTEC appoints working parties comprising members of the Council and external experts to prepare draft reports on a topic for the Council's consideration. Working parties are supported by one or more members of ASTEC's secretariat, the Office of ASTEC. The Office assembles information for the preparation of position papers, organises interviews and calls for submissions, prepares Council papers and collates or prepares draft reports. Through the Chairman, the Office may also respond to briefing requests from the Minister and prepare draft papers and speeches for Council members.

3.4 From time to time, ASTEC has provided advice to the government by means of commenting on relevant Cabinet Submissions and Budget proposals, by inputs to Prime Ministerial speeches and by briefing the Prime Minister on issues it regards as important. ASTEC therefore has both "insider" and "outsider" roles in government (see Box B), the relative emphasis on each reflecting the preferences of its Chairman and Secretary, the demands placed on it and changes in institutional arrangements. Recently, ASTEC's role in briefing the Prime Minister and commenting on Cabinet submissions has diminished and it has become much more of an outsider organisation.

Insider & Outsider Roles of ASTEC

As a statutory authority, ASTEC is part of government but removed from its day to day processes. In order to provide advice that is relevant to government it needs to be aware of the actual and potential decisions of government. This can mean participation in committees, briefing Ministers on issues and providing coordination comments on papers going to Cabinet. ASTEC's views are therefore conveyed in confidence to the government to assist it to make decisions. These functions comprise its insider role and are largely managed by the Chairman and the public servants making up the Office of ASTEC.

The outsider role is carried out through the activities conducted by ASTEC as an agency independent of government. ASTEC, in this role, is able to examine policies and decisions, gather the views of various communities and provide the government with its considered advice without necessarily being constrained by government statements and policy positions.

Membership

3.5 Council members are chosen for their personal qualities and not as representatives of particular organisations and causes. Their relationships with other individuals and bodies are seen by ASTEC as providing a strong channel of contact with the national and international science and technology community and with the wider community of users of science and technology. The combination of Council members and external specialists on working parties (and submissions to its studies) is considered by ASTEC as enabling it to use "the best minds in the country". Because the Act provides for a total of only fifteen members, a comprehensive representation of interests is not possible on ASTEC. Currently there are only ten members and ASTEC considers that this number should be increased; particularly to give greater representation on the Council to individuals with industry experience.

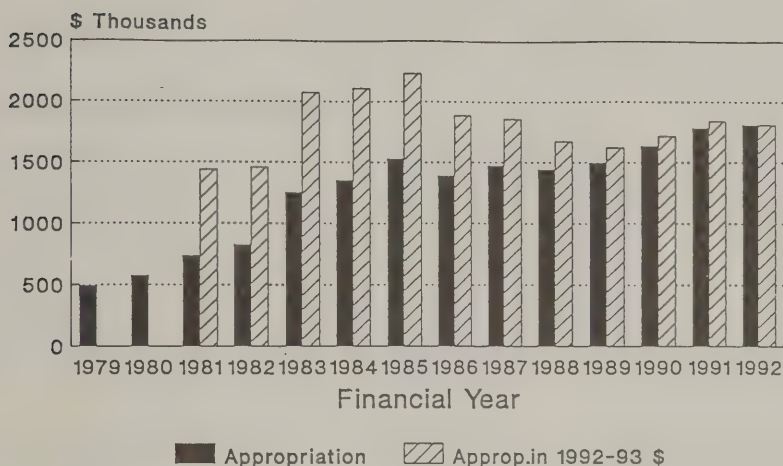
Resources

3.6 Total Appropriations for 1992-93 are approximately \$2.0 million; salaries for the Council and the Office account for \$1.1 million and administrative expenses \$0.9 million. Over the past five years, ASTEC's budget has decreased slightly in real terms. In its submission, ASTEC argued that because it was a small agency its administrative costs were disproportionately high.

3.7 Figures 3.1 and 3.2 show the history of ASTEC's funding and staff resources. The short term fluctuations were a result of additional allocations to carry out tasks specially commissioned by the government, such as *Australia's Role in the Nuclear Fuel Cycle*. Professional staff numbers in 1991-92 were the same as a decade earlier. ASTEC often relies on officers seconded from Commonwealth Departments and agencies to supplement its professional staff (three during 1991-92).

Figure 3.1

ASTEC Funding 1979-80 to 1992-93

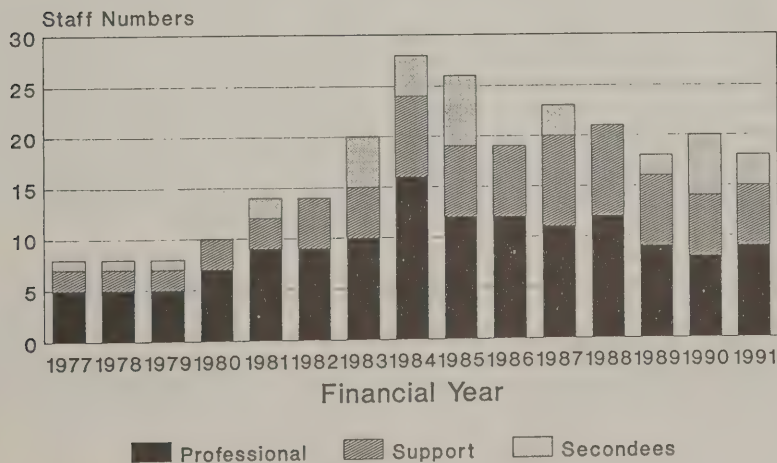


NOTE: In Figure 3.1 Appropriation for 1992-93 does not include an additional \$0.2m which was provided to ASTEC for the first time in this year to cover rental costs.

In both Figures the year refers to the financial year; so for instance "1988" in the charts refers to "1988-89".

Figure 3.2

ASTEC Staffing Resources



CHAPTER FOUR

Program Relevance

The changing S&T policy environment

4.1 When ASTEC was established in 1977, it quickly became the leading body providing science and technology policy advice to the government. There were many reasons for this. The Department of Science, in its various manifestations, operated in a less public manner and did not provide advice on the complete range of S&T issues. The informal policy advisory function of CSIRO had become less significant. While there was a broadening perception of what was meant by science and technology policy, the bodies other than ASTEC were seen as being concerned with only parts of the science and technology agenda. In contrast, ASTEC was able to range freely over that broadening agenda and its activities contributed to the broadening process.

4.2 The breadth of the agenda became even more apparent when, in May 1981 as a result of the Inquiry into Technological Change in Australia, the role of ASTEC in relation to the broader social aspects of science and technology was made more explicit. A Technological Change Committee (TCC) was established as a standing committee of ASTEC to review, on a continuing basis, the procedures and trends of technological change at the national and international levels and to evaluate and report on the direct and indirect effects of that change. After a Senate inquiry in 1988, ASTEC recommended that the TCC should be amalgamated with ASTEC. The government agreed that the promotion of technological change and the assessment of its social consequences should best be considered together in order to achieve balanced advice.

4.3 Other changes were occurring in the environment in which science and technology policies were set during the 1980s. Industry policy was moving away from tariff protection towards the creation of competitive world class industries. Microeconomic reform was recognised as a key element of this policy. These factors, together with the introduction of the 150 per cent tax concession for research and development, stimulated a significant increase in private sector investment in technology transfer and innovation. This led to a greater interest in the mechanisms necessary to capture the benefits arising from this investment and from the larger investment in public sector research. Issues relating to the application of research, to the environment and to the social impacts of science and technology became more important.

4.4 Another feature of the 1980s was the increase in the number of organisations taking an interest in science and technology policy. Non-government bodies, like the Academies, the Institution of Engineers, the Federation of Scientific and Technological Societies and the Australian Industrial Research Group started to play a more prominent role. This was exemplified by the establishment of the National Science and Technology Analysis Group

which brought together some of the major players to provide in its first years a detailed commentary on how science and technology had fared each year in the Budget.

4.5 Changes in the non-government area were accompanied by changes in the way science and technology policy was handled within government. In 1987, the government reduced the number of government departments from 28 to 17 and gave them more autonomy. The functions of the Department of Science were largely included in the Department of Industry, Technology and Commerce which was given primary responsibility for advising the government and implementing policy in relation to Australian science and technology. Other Departments also had responsibilities in relation to science and technology to support their specific functions and some of these decided to appoint Chief Science Advisers. ASTEC's role as a source of independent advice to the government remained unchanged.

4.6 In May 1989, the Statement *Science and Technology for Australia* established the Prime Minister's Science Council (PMSC), the Coordination Committee on Science and Technology, the Office of the Chief Scientist and the position of Chief Scientist.

4.7 The Statement said that ASTEC would continue to provide independent and comprehensive analysis on a range of science and technology matters. Furthermore, the then Prime Minister stated that he expected ASTEC to have an enhanced role as a result of the new arrangements as ASTEC contributed to the work of the PMSC as well as continuing its advisory role. Despite quite different compositions and methods of operation of ASTEC and PMSC, however, these new arrangements have caused widespread misunderstanding and have led to questioning about what some have seen as the overlapping of roles.

4.8 The 1992 White Paper on science and technology, *Developing Australian Ideas*, announced the change in the name of the PMSC to the Prime Minister's Science and Engineering Council (PMSEC) and for the first time provided it with formal terms of reference which were previously implicit (see Box C). The Prime Minister's Science and Engineering Council is recognised as a high level body giving a prominent profile and image to science, technology and engineering issues. Its importance derives from its Chairman, the Prime Minister; and because a number of the most senior Ministers attend, including all of those with significant science and technology elements in their portfolios; together with leaders from industry and from the science and technology communities. By its nature, and because it only meets twice yearly, PMSEC tends to focus on matters which are of immediate impact. Reports coming to it are in general prepared by working groups of individuals selected, as are the topics, in consultation between the Chief Scientist and the Prime Minister. Unlike ASTEC, it has only limited time for detailed interactive discussion of the issues put before it.

4.9 The coexistence of the PMSEC and ASTEC benefits the government's S&T policy advisory processes. The arrangement provides a means to analyse broad, longer term issues (ASTEC); as well as a very significant channel for these issues to be raised at the highest level of government (PMSEC). The PMSEC also provides a means to address issues which ASTEC may not be in a position to consider, for instance, for reasons of timing. ASTEC is currently preparing two short reports for and at the request of the

Prime Minister's Science and Engineering Council and three larger reports at its own instigation for transmission to the Prime Minister.

Box C

**TERMS OF REFERENCE OF THE
PRIME MINISTER'S SCIENCE AND
ENGINEERING COUNCIL**

1. To address important issues in science, technology, engineering and relevant aspects of education and training.
2. To examine the contribution of science, technology and engineering to the economic and social development of Australia.
3. To enhance awareness in the community of the importance of science, technology and engineering for Australia's economic and social development.
4. To examine Australia's science and engineering resources and the effectiveness of their organisation and utilisation.
5. To examine Australia's science and engineering infrastructure and the effectiveness with which it achieves the application of science and technology in the economic and social development of Australia.

ASTEC's Role in a Changing Environment

4.10 In the first ten years of its existence, ASTEC tended to be a pace setter in science and technology policy thinking. It undertook the first attempts at a stock take of Australian science and technology and at priority setting for government R&D funding and performance; it responded to government commissions to examine nuclear issues, and to examine public and private R&D performance; it set down guidelines for national facilities, international collaboration and the funding of basic research; it conducted assessments of particular technologies and it advised on energy research, marine science, and medical research, as well as on industrial R&D and innovation and on interaction among research sectors; and it provided some of the foundations for the restructuring of CSIRO, DSTO and BMR, and of research in universities.

4.11 This was its public role, but it also had a more confidential role: advising the government, on the basis of its wide ranging investigations, on Budget and other Cabinet proposals. The scope of ASTEC's consideration of Cabinet submissions increased dramatically after 1985 with ASTEC typically providing around 50 coordination comments on submissions or briefing notes to the Prime Minister in any one year. In earlier years, ASTEC had been able to provide advice on relative spending priorities as well as making specific comments on some ongoing activities. From the mid 1980s, however, ASTEC found it difficult to continue this practice. Because of the logistical difficulties in developing a representative view of the Council on many issues ASTEC decided that it should reduce the intensity of its Cabinet briefing role. Instead, it aimed to provide the government with overviews of major issues before they reached Cabinet.

4.12 In late 1987, ASTEC decided that the practice, started by Sir Geoffrey Badger, of inviting senior officials to ASTEC meetings to discuss draft ASTEC reports and related issues was no longer serving a useful purpose. The open session of the meeting had been designed to keep departments informed of ASTEC activities and ensured that the Council was aware of relevant departmental views and activities. By 1988, this practice had been discontinued and departmental interactions with the Council became less frequent and less formal. As a result of these changes (which occurred soon after the significant reduction in the number of departments), ASTEC started to assume a more detached and analytical role without substantial involvement from the internal workings of government.

4.13 One exception was ASTEC's involvement in the development of the government's 1989 Statement, *Science and Technology for Australia*. ASTEC also provided briefings to the Prime Minister on several new developments in science and technology which were of current or potential political interest. Once the Office of the Chief Scientist was established in 1989, these briefings were discontinued as was ASTEC's routine access to Cabinet material.

4.14 A joint report with the Australian Research Council in 1990 recommended that the government periodically set policy directions or guidelines for research. The government agreed that it would release a White Paper on science and technology based on an issues paper prepared by ASTEC. As a result, in 1991, ASTEC devoted most of its resources to the preparation of *Research and Technology: Future Directions* which involved extensive consultation with the science community and to a lesser extent with industry. In the

event, ASTEC had only a minor involvement in the preparation of the 1992 White Paper which was managed by the Office of the Chief Scientist.

4.15 ASTEC's current work program stems from themes raised in *Research and Technology: Future Directions*. Meetings of experts were convened, once the topics were decided, in order to determine the most relevant issues. ASTEC has also developed the practice of holding seminars to publicise and explain its reports once they are published.

4.16 There is no question that, in terms of the functions it is charged to perform, ASTEC is a relevant and useful government funded program. In the next two chapters, we examine how well it has carried out those functions.

CHAPTER FIVE

ASTEC's Approach to its Tasks

Introduction

5.1 Developing policy advice involves:

- taking a difficult and sometimes poorly understood problem or issue and structuring it so that it can be thought about in a systematic way;
- gathering the necessary information and applying appropriate analytical methods;
- formulating effective options addressing, where necessary, mechanisms for implementation, monitoring and evaluation; and
- communicating the results of the work to government and to other stakeholders in a timely and understandable way.

We will broadly follow this outline in evaluating the process used by ASTEC in developing its policy advice.

Issue identification

5.2 Because ASTEC has limited resources, it is important that the issues and problems it chooses to study are the most relevant and critical to the long term efficacy of the nation's science and technology endeavours. Over the past fifteen years, ASTEC has played a prominent role in the identification and development of science and technology policy in Australia and, on certain issues, in other countries. This has taken a number of forms including: redefining the objectives of public S&T agencies; raising critical S&T policy issues for the government to consider (eg, tax concessions for R&D; purchasing policy as an instrument of innovation policy; research infrastructure; research personnel projections; research direction and priority setting; and the relative national and international performance of Australian research); the formulation of systematic approaches for allocating resources to major scientific activities; and investigating specific issues with a science, technology or technological change focus (eg, robots, biotechnology, electronic funds transfer).

5.3 There is a consensus in the submissions we received, and in the survey performed by the Centre for Research Policy (CRP) for ASTEC, that ASTEC has identified a substantial number of relevant issues particularly relating to its functions of advancement of science. Many of these issues ASTEC was the first to recognise. There is also a broadly held view, accepted by the Review Committee, that ASTEC has been less diligent in addressing

its functions relating to the application of technology. ASTEC is perceived in the CRP survey as having a significant impact on science related issues in relation to government policy, but a diminishing impact and role on issues more closely defined as technological or industrial applications of science and technology. We are aware that ASTEC has adopted a better analysis of the impact of industry structure on the development of technology strategy in recent years. This analysis has had minimal influence on government and industry but it has contributed to a slow but steady acceptance by researchers of the need for greater economic effectiveness in the conduct of scientific research.

Determination of the Work program

5.4 There are four ways in which an issue becomes part of ASTEC's work program:

- a) it is referred to ASTEC by the government with little or no prior consultation with ASTEC (eg, *Australia's Role in the Nuclear Fuel Cycle*);
- b) it is conceived in a government agency and the terms of reference are developed in concert with ASTEC (eg, *Health, Politics, Trade: Controlling Chemical Residues in Agricultural Products*);
- c) it is conceived within ASTEC and the terms of reference are endorsed by the Prime Minister or another relevant Minister (the majority of reports); or
- d) it is conceived within ASTEC and acted upon.

5.5 The Review Committee considers that most of ASTEC's work should be designed to meet the longer term needs of the government. There is not, however, enough discussion of the potential work program outside ASTEC. The Centre for Research Policy survey found that there is some confidence in the consultative process adopted by the Council during its actual work program but remarkably little confidence in the level of consultation during the process of establishing its work program. More open consultation is required in all phases of ASTEC's work, but particularly in the issue identification phase. Without identifying major clients for policy advice, and involving them in formulating terms of reference for studies, the resulting outputs are unlikely to be sufficiently focussed or to address specific short or long term needs.

Identification of stakeholder needs and the role of sponsors

5.6 ASTEC has no power to implement its recommendations. It is therefore important for the Council to be clear at the outset which are the most appropriate individual and organisational stakeholders¹ in the public and private sectors. If this audience is not considered in the initial stage of developing a study, subsequent implementation of the recommendations is less likely. It is especially important for ASTEC to "map" the stakeholders early in its work program selection process.

5.7 Government commissioned reports are more likely to be taken into account in the consideration and determination of policy. ASTEC's work will have responded to a government concern and the government will be receptive to measures which can lessen that concern. It may mean, however, that only some of the more specific and practical recommendations are implemented while the more general ones, such as those dealing with procedures for future decision making, may be laid aside.

5.8 Where references have not been sponsored in this way but have been generated by ASTEC itself, careful thought is required about the timing, the stakeholders and the "champions" who are going to see through the implementation of recommendations. The champions may be in the public or the private sector and should be identified appropriately and be at a sufficiently high level to influence government thinking. Too often the issue of who will take up the cause - the champion - has not been adequately addressed.

5.9 It is not solely ASTEC's task to identify issues of relevance to science and technology policy making. Other bodies, and individuals, should draw ASTEC's attention to issues they think are relevant. ASTEC's capacity to identify relevant issues to raise with the government must be improved by broader consultation; this means meeting in capitals in addition to Canberra (to facilitate interaction with, for example, State S&T bodies), calling for suggestions from stakeholders, circulating its forward work program for comment and so on. There is also an implication here for ASTEC's products. A concentration on major research reports is not always the best way to raise relevant issues for government consideration. A short briefing paper would sometimes be a more suitable way to alert the government to a problem or an issue ASTEC considers important. Identification of an issue can be a contribution to the debate (and therefore can fulfil an ASTEC function) even if ASTEC does not investigate it further.

5.10 The Review Committee was struck by the number of submissions recommending that ASTEC devote more resources to issues relevant to industry. We are well aware, however, of the considerable difficulties this course of action raises in practice. The difficulties arise from a number of sources:

¹ A stakeholder is, in this context, an organisation, individual or interest group which has a point of view on or may be affected by the advice to or decisions by government.

- different industries, and different companies within the same industry, have different research, development and innovation needs and capabilities, so developing an "industry view" could result in generalisations which do not point clearly in a particular policy direction;
- innovation involves a broader set of changes and activities than research and development and tends to be firm-specific in nature;
- in planning the future direction a business should take innovation is more likely to be viewed in the first instance in the context of investment, capital availability and industrial relations than in terms of technology transfer or research and development;
- companies may not wish to articulate their technology and innovation strategies, for competitive and other reasons, and it is often not regarded as being of a high priority to spend time doing so for government agencies.

5.11 We therefore consider that the question of ASTEC's relationship with industry is complex and is unlikely to be properly fulfilled by sporadic consultations or by examining technologies in isolation from their economic context. ASTEC will need to develop a strategy to ensure that the views of industry are brought to bear on all of its activities and judgements. This is a difficult area but it is important that it be addressed.

Systematic structuring of topics

5.12 ASTEC has developed the practice of preparing an issues paper for each study in order to structure the topic to be investigated and to summarise the relevant issues. These issues papers are usually written after a decision is made (formally or informally) to begin a full investigation of a topic. We consider that more use should be made of issues papers to inform and assist the selection of topics for ASTEC to investigate; they could be prepared within ASTEC or externally.

5.13 At present, issues papers are used to inform working parties of the possible scope of the study, to inform the Council of the issues under investigation and also to advise selected individuals of the study's directions. To continue our theme of the need for broader consultation, we suggest that ASTEC distributes its issues papers widely to inform the relevant interested parties; and to generate both feedback on the structure of the investigation and to start the process of engaging stakeholders in the aims and outcomes of the study. The Council should be prepared to modify the structure and aims of a study based on this interaction.

Gathering the necessary data

5.14 The general impression of ASTEC's investigatory activities is favourable and these activities are seen as useful and appropriate according to the submissions we received. ASTEC usually advertises for submissions, undertakes literature searches, and consults the

individuals and organisations which it considers have valuable insights into the topic within Australia and sometimes in other countries. Depending on the issue, ASTEC may also collate, or undertake surveys to collect, information it deems necessary for its investigation. These procedures range from moderate to extensive in scope.

5.15 While there have been occasional criticisms of some of the data collection methods used by ASTEC, this has been constructive in encouraging those involved to collect and examine their own data in order to enter the discussion of the matter under inquiry. We agree with comments received that ASTEC must be encouraged to continue its process of developing considered propositions based on verifiable data.

Formulating effective policy advice

5.16 The process of transforming information into policy advice is particularly difficult. The survey and case studies available to the Committee indicate that ASTEC sometimes makes it more difficult by not adopting, or apparently not recognising the need for, a systematic approach to this activity. The result is that some reports are better at formulating effective policy advice than others. For example, in a number of reports ASTEC's analysis of an issue is seen as generally sound while in others it is seen as inadequate. In a number of cases, ineffective use tends to be made of the inputs gathered by means of submissions and consultations. ASTEC's performance in the analysis of issues is patchy, particularly at the applied end of the science and technology spectrum where it has not been very successful in influencing policy development. We have found that ASTEC has not always had a strong grasp of the process and timing of policy development in government and this has detracted from its ability to provide sound policy advice.

5.17 ASTEC needs to be aware of a broader agenda, of changing priorities in the policy environment, of reactions of stakeholders to other policies operating in the arena and, especially, of where the set of issues on which it focusses its attention fits into related policy frameworks. In framing its advice, ASTEC also needs to be aware of what a government can and cannot do. In some cases, ASTEC's recommendations do not take these considerations into account and are therefore regarded by policy advisers as not capable of being implemented.

5.18 It is rare for ASTEC to construct and consider a range of options or to address issues of implementation, monitoring and evaluation when formulating its advice. It is now only one of a number sources of advice and the policy process is more highly contested and subject to stringent resource constraints. ASTEC needs to formulate options and their costings; present the arguments for the course it considers to be the most effective; and indicate how best to implement it.

Communicating the results in a timely and understandable way

5.19 There are two principal aspects to timeliness. One relates to identifying an issue in good time for a government to make a considered response. The other relates to

conducting the policy work in a timely fashion. When ASTEC has been given deadlines for the completion of commissions, it has invariably met them. It is less successful at injecting its internally generated studies into the policy process at the most opportune time.

5.20 ASTEC has not always recognised that it has a continuing role in "marketing" its advice once the reports which set out that advice are released. (There has been a tendency to let others take up the responsibility to argue for the recommendations if they so choose. As a result, the chances of recommendations being implemented diminish.) In the past three years, ASTEC has held public forums where it has explained its major reports and invited papers from others commenting on those reports. More recently, ASTEC has distributed, on a limited basis, information sheets on its current studies. We believe these activities are useful, but there are many other avenues for communicating its outputs to a range of specialist and general audiences. We concur with the comments of one Minister to the Review that, while it is a valuable organisation, ASTEC needs to raise its public profile substantially. One way to do this is to include among the topics selected ones which have broad relevance; another is to package findings in ways which suit different audiences.

5.21 Rather than constituting policy advice, some more recent reports have given the impression of being background information which others can use in developing policy advice. ASTEC should consider producing two styles of report - one a short policy oriented document; and the other detailing the information on which it is based. This will assist the Council in formulating its policy advice and also assist in the effective communication of that advice.

CHAPTER SIX

The Effectiveness of ASTEC's Outputs and Outcomes

Introduction

6.1 The Review Committee consulted widely on the matters considered in this chapter; and drew on a commissioned study by Professor Jane Marceau and Mr Don Scott-Kemmis which examined in depth outputs and outcomes from reports selected by the Committee. It also had the survey which ASTEC commissioned for its submission; and the comments contained in the submissions to the Review.

6.2 ASTEC has produced more than seventy reports to the Prime Minister which represent a considerable and diverse body of documentation, analysis and policy advice. We have not examined every one of these closely, but we are confident in drawing general conclusions about this body of work based on the converging perceptions arising from a wide range of information sources. We are also aware that while reports represent ASTEC's most visible outputs they are not the only, or even necessarily the most significant, output of ASTEC activity. It is often the interaction between the product (the report) and the process (consultation before and during the inquiry and post-report activities) that influences the eventual outcome.

THE EFFECTIVENESS OF ASTEC'S OUTPUTS

The Quality of reports

6.3 The quality of ASTEC's reports appears to be uneven. During the late 1970s and throughout the 1980s, ASTEC represented a strong independent voice and many of its reports had a significant impact on government decisions. Its first major report *Science and Technology in Australia 1977-78* contributed to placing S&T issues firmly on the government's agenda. *Australia's Role in the Nuclear Fuel Cycle* and the reports on R&D in various sectors (government, universities and industry) stimulated debate and in a number of cases provided the catalyst for major institutional restructuring or policy developments. The review of CSIRO was initiated at a critical time for the Organization and has set it on a course of greater responsiveness to industry. ASTEC's reports on specific research areas such as *Microelectronics* and *Biotechnology* were informative and well received by government and the research community. Our interviews, and submissions to the Review, strongly support these perceptions.

6.4 We were impressed that authoritative commentators from other countries found that those ASTEC documents they had studied compare favourably with those produced by Japan's NISTEP, by the NSF and OSTP in the USA, and by comparable bodies in the United Kingdom and France. One distinguished commentator noted that ASTEC achieved

the quality of its output even though it did not have the depth of scholarly resources available to the U.S. National Research Council or to major overseas universities that specialise in policy research; it was considered that, despite its modest resources, ASTEC reports tended to be quantitative, well organised and crisp.

6.5 More recently, some of ASTEC's reports have been perceived as less effective than the earlier ones. This may be because of the broad and often difficult nature of some of the issues tackled by ASTEC, such as infrastructure or research priority setting; and partly because the reports are now put out into a much more contested policy environment. Also ASTEC has had the courage not always to reflect the views of the higher education system and the broader research community. As a consequence, the Council's reports have been the subject of criticism from what some would regard as vested interests.

6.6 Some ASTEC reports have concentrated on establishing fundamental positions and can endure as valid policy documents for perhaps up to a decade. Others have been concerned with more immediate issues and therefore need to be timely, persuasive and readily implementable. Where such reports have not been of this nature, they appear to have been of less relevance as policy advice to government. The persuasiveness of ASTEC reports is variable. On the one hand are the reports on *Australia's Role in the Nuclear Fuel Cycle* and *Future Directions for CSIRO* where almost all the recommendations were accepted. On the other hand *Improving Australia's Competitiveness through Industrial Research and Development* (1987) and *Research and Technology: Future Directions* (1991), while being broad and ambitious and suitable for ASTEC to conduct, appeared to be neither particularly successful at crystallising the issues and options nor influential. The significant effort that was involved in producing these reports provided little in the way of new information on issues of critical importance despite ASTEC's aim in both cases to write reports that would strongly influence government and industry.

6.7 This raises the question of what should be an acceptable "strike rate" for ASTEC recommendations. A high rate of acceptance is most difficult to achieve when an advisory body is dealing with long term and strategic issues; and easiest to achieve when the issue is highly specific and limited in scope. There is evidence that ASTEC has been both successful and unsuccessful in each of these categories. It is also important to realise that ASTEC's immediate persuasiveness, and/or the record of acceptance of its recommendations by the government, is not necessarily the most appropriate measure of the quality of its advice. Furthermore, ASTEC should not bear all the blame for lack of action on its recommendations particularly, for example, when departments are unable to agree on a common course of action. Its demonstrated ability to raise awareness of an issue with government and the various science and technology communities is commendable; as is its enduring interest in particular policy areas. Research priority setting and the R&D tax concession, both highlighted in the late 1970s, are prominent examples.

6.8 Timeliness is critical in gaining acceptance of the analysis and in ensuring that the recommendations have a good chance of being implemented. The policy advice should be forward looking and correctly recognise emerging issues and problems. ASTEC does not have a good record of producing self-initiated reports which are viewed as timely by

policy makers. For example, timing seems to have been one of the crucial aspects in the overall negative assessment of *Improving Australia's Competitiveness Through Industrial Research and Development*. The report appeared soon after a period in which the government had introduced a range of measures to promote industrial R&D and it was too early to assess whether those measures were having the intended effect.

6.9 ASTEC usually does an excellent job in providing the type of detailed statistical and other information on Australian scientific and technological endeavour which is essential if decisions on science and technology are to be soundly based. In this context, it scores highly against the criteria of comprehensiveness and accuracy.

6.10 An example of this type of work is the *Profile of Australian Science* (1989). Submissions to the Review commented that it presents an objective and helpful mirror of national performance - a view that we share. We also agree with comments we received that *Science, Technology and Australia's Future* (1989) marked a more penetrating analysis from ASTEC than hitherto of the economic role of research and provided authoritative support for a realistic picture of R&D expenditure targets for industry. ASTEC also deserves some credit for shaping CSIRO's priorities and contributing to changes in attitudes on the part of university researchers regarding interaction with industry.

6.11 On the other hand, ASTEC bears some responsibility for the late recognition by Australian S&T policy makers of the significance of the globalisation of technology and the fundamental rethinking of productivity and management procedures in industry.

6.12 The views of the private sector were confined to comments on *Research and Technology: Future Directions* as it is seen as the only recent report that impacts on this sector. We were advised that substantial submissions from private companies and industry bodies to the report process did not seem to have received any critical review. From a private sector perspective, the report appeared to be only a collation and summary of submissions; it was "*an academic and lengthy analysis of often nebulous matters and totally failed to recognise the urgent necessity for Australia to improve its ability to commercialise its research. Its failure to identify priorities and its view that no major changes to the present system are necessary, only encourages Government inaction, to Australia's detriment*".

6.13 It is clear from these comments that ASTEC's consultation process in that instance was deficient: although key industry people were consulted on their views they were not consulted on the analysis and findings that ASTEC developed as a result.

6.14 We agree with submissions to the Review that ASTEC places too much emphasis on traditional R&D with a consequent lack of emphasis on non-S&T factors affecting the development and use of technology such as those that arise from industrial and institutional structures, the importance of generic technologies and the increasing internationalisation of science and technology.

6.15 ASTEC is more comfortable and more successful in overseeing specific investigations where it can provide objectivity yet draw on a large pool of external

expertise. Recent reports that have addressed specific issues, such as *Funding the Fabric* and *Major National Research Facilities*, have contributed to the current debate on the future funding of research infrastructure in universities. *Funding the Fabric* tackled some of the policy aspects of the research infrastructure problem in universities but it did not provide the data required for detailed government policy decisions. Another inquiry is now being conducted by NBEET. In contrast, *Small Country - Big Science* contained comprehensive information (drawing on work previously done by external members of the working party) which provided a basis for moving forward with an authoritative set of priorities. The analysis of the problem in *Casting the Net* was also seen as excellent by stakeholders but they considered that the policy analysis and formulation were inadequate; as was the consideration of the requirements for effective implementation.

6.16 The broad conclusions we draw from this are that ASTEC tends to operate with rather too much emphasis on research and analysis and insufficient emphasis on policy formulation; and, flowing from this, insufficient attention is given to understanding, preparing and influencing the policy context of the topics it studies. The process of policy development is iterative, interactive and complex and ASTEC will need to be aware that merely gathering the views of stakeholders is no longer sufficient. Possible courses of action also need to be canvassed.

6.17 We consider that ASTEC needs to develop further its capacity to undertake the more intractable and strategic studies which no other body is in a position to undertake - and to do this even though achieving successful outcomes is difficult. Given its recent experience with these types of studies, ASTEC will have to examine the design and implementation of its procedures and ensure that it can attract the skills and capabilities which will result in the output having authority, legitimacy and technical credibility - factors which contribute to the persuasiveness of the advice. The mandate to work in these areas needs careful justification and this justification should be apparent in the terms of reference, inquiry process, selection of recommendations and, especially important, in "selling" the report to immediate stakeholders and to others likely to influence the outcome. The recommendations need to be tailored accordingly.

THE EFFECTIVENESS OF ASTEC'S OUTCOMES

Utility, including feasibility of recommendations

6.18 As we noted above, to be of use to the government and other stakeholders, policy advice should identify the implications of different options and alternatives, present cost-effective solutions to problems and should be practical to implement. Examples of reports where ASTEC's information and analysis have assisted the development of government policies are *Setting Directions for Australian Research* which proposed the S&T White paper process; *Environmental Research in Australia* where the issues paper contributed significantly to the draft Ecologically Sustainable Development reports; *Profile of Australian Science* which is a benchmark for the strengths and weaknesses in scientific research in Australia as well as the stimulus for a number of policy developments and analyses; the *Core Capacity of Australian Science and Technology* which stimulated a

number of the proposals in the 1989 Science and Technology Statement; and *Improving the Research Performance of Australian Universities* and *Education and National Needs* which together set a number of the parameters for the reform of universities in the mid to late 1980s.

6.19 In spite of the assistance government has derived from this work, the survey conducted by the Centre for Research Policy for ASTEC found that nearly two thirds of the respondents considered that the information (ie, advice) provided by ASTEC was not perceived as being readily implementable. We have interpreted this as referring to more recent reports and suggest that ASTEC needs to re-examine the framing of recommendations to improve their utility; but also to enhance the promulgation and understanding of its principal recommendations in the science and technology and industrial communities.

6.20 In the case studies of four ASTEC reports, our consultants found a variety of causes for the relatively low effectiveness of the outcomes of reports. Most served a useful purpose in raising awareness of the issues; and, in one case, the desired outcome was achieved even though the ASTEC recommendations were not followed. In another, there was insufficient understanding of the implementation constraints arising from the fact that the issues spanned several departments and several levels of government; and, in more than one case, there was insufficient understanding of the difficulties likely to arise when choices between activities had to be made by organisations such as CSIRO which had different priorities. In one case ASTEC chose not to take risks, not to manifest leadership or a clear position, and to raise and then disappoint expectations. The report of this consultancy will shortly be available as an ASTEC Occasional Paper.

Impact on policy development

6.21 ASTEC reports have tended to become longer, more academic and more discursive with the passing years. Commonwealth departments consider that some recommendations are not sufficiently specific and the supporting arguments not cogent enough for direct translation in policy. Various ASTEC reports have been deficient in terms of one or more of the following: timeliness, relevance, persuasiveness, novelty, focus and analysis of the economic dimensions of industrial R&D and competitiveness. As a result, recommendations were not seen by policy makers as contributing valid arguments to support the measures proposed.

6.22 In some cases, we have evidence to suggest that ASTEC has provided information and analysis to assist in the development of relevant government policy. In others, we are aware that this did not occur. We conclude that ASTEC is better at analysing an issue than developing policy-relevant advice resulting from that analysis. The Council needs to give greater attention to the implementation of the courses of action it recommends if it is to have the fully effective voice in government S&T policy we regard as necessary.

6.23 Notwithstanding the foregoing, we acknowledge that it is difficult to assess the impact of a single player on the development of government policy. Many influences bear

on government and the paths of that influence are difficult for even those involved to discern.

6.24 ASTEC has taken a strong stand for a long period on several major issues (eg, the R&D tax concession, public sector research infrastructure, Australian Research Council), and has seen its recommendations implemented as government policy. It has also successfully recommended changes to the structure and direction of most of the Commonwealth Government's research performing agencies.

6.25 ASTEC is now more aware of the need to minimise the above mentioned deficiencies but we consider that a greater concentration on the measures to avoid them, through closer scrutiny of the selection, planning, conduct, and drafting of reports is required by the Council; as well as detailed deliberation of the drafts and the strategies to maximise the exposure and adoption of the advice. The critical element of a successful report is the expertise and professional support available in its preparation. A key control factor is therefore the selection of the convenor and members of the working parties. This is a matter which requires judgement and skill and considerable time and effort need to be given to it, largely by the Chairman and the Secretary.

6.26 ASTEC inherently possesses the independence, cross sectional representation, impartiality, and a capacity for objective, informed judgements necessary to gain the confidence of government, industry and the science and technology community. ASTEC has brought a methodology and discipline to the science and technology debate which should not be lost. The publications it has produced on the whole form a valuable and objective resource for those involved in the development of science policy. Nevertheless, ASTEC could have played an even more influential role had it interacted more closely with the stakeholders; prepared the ground and selected the right time to launch its advice; and followed through its reports with the agencies charged with implementing them.

CHAPTER SEVEN

Conclusions and Recommendations

Introduction

7.1 The Review Committee was asked to evaluate ASTEC's objectives, performance and outcomes in the context of the provisions of the Australian Science and Technology Council Act 1978 and to recommend actions to improve ASTEC's performance and effectiveness. This report represents the conclusions reached by the Review Committee as a result of extensive deliberations and the consideration of a range of options for the future of ASTEC.

7.2 The environment in which ASTEC now operates is changed significantly from the environment of the late 1970s and early 1980s. The government now has available to it several governmental sources of advice on science and technology matters, including science experts within departments, the Prime Minister's Science and Engineering Council, the Office of the Chief Scientist and the Coordination Committee on Science and Technology. This has led some to question the role of ASTEC.

7.3 The Review Committee, however, has no hesitation in endorsing the role assigned in the Act; nevertheless, we do feel that ASTEC has lost some of its initial drive, has become rather set in its ways and needs to become more enterprising and imaginative in tackling its tasks.

7.4 The conclusions and recommendations of the Review Committee are set out below. In summary they are:

- **ASTEC should continue as a separate organisation with its present functions**
- **ASTEC itself needs to appreciate and come to terms with its distinctive role**
- **ASTEC's capacity to carry out that role needs to be strengthened**
- **ASTEC should implement, after review, a series of measures to enhance its effectiveness.**

RECOMMENDATION 1

ASTEC should be retained as a separate statutory body.

1a There is no need to change ASTEC's enabling legislation.

1b There is no need to change ASTEC's functions as set out in its Act.

1c ASTEC should continue to report to the Prime Minister.

7.5 It will be clear from the foregoing that the Review Committee considers that the original conception of ASTEC's role is distinctive and that it is still valid today. ASTEC's distinctive role stems from the nature of ASTEC itself - a statutory body standing outside the institution of executive government which, within the fields of science and technology, is broadly based in terms of its membership, and whose members should be able to bring a wealth of knowledge, skills, experience and associations to its work. These attributes should allow ASTEC to stand back from the more immediate issues and to provide advice going beyond the policies of the government of the day: it is in this respect that ASTEC is essentially different from other S&T advisory bodies in Australia.

7.6 ASTEC is well placed to provide information and advice to government on broad and strategic issues. This is its core role. It is not limited in the advice it can provide and is able to look across the range of science and technology to identify difficulties and opportunities.

7.7 We agree with the findings of the Centre for Research Policy survey that ASTEC should focus on science and technology issues from a perspective that is wider than that of the immediate concerns of the science community. The Committee believes that the following should be considered in the formulation of ASTEC's future strategy:

- a strong focus on the consultative role;
- emphasis on the provision of consolidated views of the science, technology and related industrial communities to government;
- a focus on the longer term issues of direct relevance to government;
- greater emphasis on assessment of the effectiveness of S&T spending by government, leading to the formulation of reallocation strategies;
- development of longer term visions of the threats, opportunities and likely scenarios for the development of science and technology; and the policy responses necessary for the government to make (ie, shaping the S&T policy agenda);
- articulation of the future directions of science, technology and innovation so that efficient adjustment patterns may be charted.

7.8 Discharging the core role is not without its problems. Many of the issues dealt with will be complex and difficult and ASTEC may have no immediate results to show for its work. The influence of its work may only be seen over time. Part of ASTEC's task is to communicate and promote its views. These aspects need to be understood.

7.9 There will be occasions when ASTEC, because of its broad membership base or particular expertise, will be able to provide information and advice on more immediate issues. ASTEC will need to ensure that it balances this work with its core activities so that "the urgent does not drive out the important".

RECOMMENDATION 2

ASTEC needs to develop a clear appreciation of its role and translate this into objectives, strategies and activities.

7.10 ASTEC's mission and goals are set out in its 1990-92 Corporate Plan. In addition objectives, strategies and performance criteria are set out in other documents. The high level mission statement (see below) depicts a role for ASTEC not dissimilar to that envisaged for ASTEC in this report.

Box D

ASTEC'S MISSION

To help shape national policy and decision-making on science and technology and their application to the national well-being, by providing independent advice to the Prime Minister, and by influencing the attitudes of government, industry and the community.

ASTEC Corporate Plan 1990-92

7.11 The evidence available to the Review Committee suggests that there is little commitment within ASTEC to the 1990-92 Corporate Plan. Accordingly, the Review Committee recommends that the Corporate Plan be redeveloped. The process of developing a corporate plan can be as important for the organisation as the plan itself. It can facilitate the development of a common understanding of the organisation's role and how that role should be discharged in the immediate future. The Review Committee considers that it is particularly important for a body like ASTEC that there be widespread participation in this process.

7.12 In 1988, ASTEC was charged with continuing the activities of the Technological Change Committee (TCC) when that Committee was absorbed into ASTEC. There has been little work done in the area formerly covered by the TCC. We believe that it is important that technological change matters continue to be considered when ASTEC determines its work program.

RECOMMENDATION 3

ASTEC's capacity to carry out its role needs to be strengthened.

3a *ASTEC should appoint the full complement of fifteen members of whom no fewer than five should have industry backgrounds.*

Composition of the Membership of the Council

7.13 The members provide ASTEC with a standing and potential influence which imposes on other parties the need to take ASTEC's selected issues and outputs seriously. ASTEC is a forum which is broadly based and multidisciplinary. It allows the cross fertilisation of ideas from scientists, technologists, academics and industrialists. There is a continuing need for government to receive information and advice derived from such interchange and the development of ideas by individuals of high competence in their fields. ASTEC's value is greatest when it takes on the hard, multi-faceted, difficult to define issues, where lateral thinking and the bringing together of a broad group of well informed individuals is essential. This is ASTEC's great strength and the organisation needs to be built around it.

7.14 We consider that if ASTEC is to operate effectively as a deliberative body then the full complement of members allowed under its Act, fifteen, should be appointed. It is apparent that at its current size of ten members ASTEC is operating in a suboptimal fashion.

7.15 The members of ASTEC should continue to be selected on the basis of their ability to contribute as individuals to the provision of science and technology policy advice in terms of ASTEC's functions. This means more than narrow technical expertise. It means an ability to cross disciplinary boundaries, to integrate knowledge from several fields or sectors and to understand the scope, limits and constraints associated with the policy issues dealt with by ASTEC. And it means that the individuals should have a significant standing amongst their peers. Not fewer than five of the members should come from private industry or be persons with substantial industrial experience. These should be senior persons usually below the chief executive level and preferably with at least some experience in R&D, technology transfer or innovation.

7.16 As government functions become more devolved and ministerial control over day to day operations is lessened, the restrictions which have historically been placed on individuals employed by governments becoming members of the Council is less appropriate. Individuals not closely involved in providing policy advice to the

Commonwealth Government should be eligible for membership. They could include employees of State Governments, government business enterprises, and utilities, as well as some Commonwealth officers. Also to be included, as an opportunity and not a requirement, are those skilled in social sciences with a knowledge of the processes and application of science and technology.

Operations

7.17 It is for the Council, through the leadership of the Chairman, to decide what are the meaningful questions for ASTEC to investigate and then to bring together the right mix of capabilities from within the Council and from outside. ASTEC will operate in different modes according to the nature of its inquiry. We see a great deal of merit in it operating in a tightly focussed fashion in response to government commissions.

7.18 The Council needs to accept that its most enduring contribution will be in influencing the thinking of governments, the science and technology communities and industry, rather than the production of reports. There are major implications here for its mode of operation in terms of selecting the right opportunity to inject new ideas, developing alliances in policy and spending departments and using personal contacts to build up trust and two way exchanges of ideas.

Structures

7.19 With a full time secretariat and a part time Council, ASTEC has to rely on the members of the Council to supervise and direct the Council's activities. The major responsibility for acting as both a driver and a filter rests with the Chairman.

7.20 An effective Council needs to be balanced and informed, especially on key policy issues, and able to count on the work provided by the secretariat being bureaucratically sound. While a number of submissions held that the secretariat had too great a role in writing the reports, we do not consider this to be an issue provided the Council steers the process and exercises strong quality control. In this context, if the Council believes that specialist professional skills are available elsewhere to prepare a draft more cheaply, more quickly or with more authority, then it should consider arranging a contract for the provision of these services. There is no reason why a working party should not supervise some or all of the data collection and analysis. ASTEC should not be committed to a single solution for gathering its inputs and should explore more flexible approaches.

7.21 Every ASTEC report is drafted under the direction of a working party of ASTEC members, and of late, external experts. We consider this to be a most effective mechanism which should be continued and developed. While we recognise that the ultimate responsibility for a report rests with the Council, the convenor of a working party will often play a major role in the conduct of the study and the preparation of the report. We believe that this responsibility ought to be acknowledged more clearly and more formally than at present. We therefore suggest that normally in the letter of transmittal of a report, the convenor of the working party be identified as such and co-sign that letter

with the Chairman of ASTEC. This convention will also provide a greater element of accountability to the process.

RECOMMENDATION 4

ASTEC should implement, after review, a series of measures to improve its effectiveness.

Identification of relevant issues

7.22 ASTEC's brief is to provide the government with the best broadly based advice that it can. The government needs a source of new ideas and an early warning of difficulties on the horizon. These need not always take the form of major reports. In appropriate instances, brief outline papers should be prepared which raise an issue (say, with the PMSEC or groups of officials) and which start to form a climate of opinion about it - these may be used later if ASTEC proceeds to a larger scale study. Attention should be given to current awareness or scanning activities in order to ensure that ASTEC is properly briefed on new developments in S&T policy and policy-related research.

7.23 One conclusion is particularly clear: ASTEC's work has been heavily skewed towards science at the expense of technology and, within science, there has been some emphasis on the physical sciences at the expense of the biological and health sciences. If ASTEC had been adequately addressing the full range of its functions, there would be a reasonable expectation that it would have brought relevant aspects of the ecologically sustainable development or total quality management issues, for instance, to the government's attention before others did so.

Procedures

7.24 While ASTEC has developed adequate mechanisms for capturing the perceptions of particular communities, we consider that further attention needs to be paid to:

- (i) the process of determining ASTEC's work program, including consultation at a senior level with the government; identification of, and consultation with, government agencies likely to have responsibility for implementing recommendations; and justification in its annual report of the issues selected;
- (ii) detailed attention to the issues raised in draft reports by the Council so that the final result truly reflects the considered views of the Council;
- (iii) ensuring that the implementing agencies are aware of and to some extent persuaded by the arguments and recommendations made through consultations and circulation of material (including a range of options and recommendations) for comment; and
- (iv) identification and support of champions for its recommendations so that there is a stronger possibility of implementation.

The carriage of these interactions rests principally with the Chairman of ASTEC, preferably personally, but also by delegation. There need to be two or three change agents in ASTEC working in different circles of influence; we expand on this aspect in paragraphs 7.26 to 7.29.

Frequency of meetings

7.25 In the past few years, ASTEC has tended to meet on a two monthly basis rather than monthly. We consider that regular monthly meetings during most of the year are essential for performance and to provide the opportunity for deliberation and interaction, as well as reporting, control and direction. Only with this frequency will ASTEC be able to maintain the required timeliness and iteration necessary in writing an authoritative and influential report. In order to signify the primacy of the Council in the affairs of ASTEC, we consider that it is appropriate for ASTEC to return to the meeting arrangement whereby, apart from the Secretary, members of the secretariat only join the Council table when the Council is discussing matters on which they have been directly working. It may be more practical on occasion, too, to hold meetings in centres convenient to the membership of the Council rather than always in Canberra.

Role of the Chairman

7.26 The Chairman needs to be in continuing liaison with senior officials involved in science and technology policy, with the interest groups which provide inputs to their policy deliberations, with those involved in the execution of S&T programs and with the users of the outputs of S&T. Desirably, the Chairman will also be involved in external activities of the kind that will bring him or her into contact with a range of opinion, such as membership of boards, associations and institutions. Preferably, on average, about half of each week should be spent on ASTEC business.

7.27 The Deputy Chairman needs to be viewed as a significant contributor to the work of ASTEC and should, if possible, have complementary interests and experience to those of the Chairman.

7.28 The Chairman has to take leadership responsibility for defining and promulgating ASTEC's program strategy after adequate consultation. The Chairman needs to have a strong view of ASTEC's mission, the relative emphasis to be given to each statutory function, and what should be achieved in a five year term.

Role of the Secretary

7.29 The role of the Secretary is to support the Chairman and to fill in those areas and activities relevant to ASTEC's mission where the Chairman's participation is less appropriate. There is also an additional and most significant role. For ASTEC to advise the government with the greatest efficacy, it needs to have strong links on a day to day basis with the workings of government. The Secretary of ASTEC is the key to this insider

role. He or she provides a crucial link between the government and the Council; providing a two way flow of information on the timing, relevance and significance of policy proposals and actions. While the Chairman also has a role in this activity, the mainstay is the Secretary. The standing and personal attributes of the Secretary need to be such as to develop and maintain links with the key players. The Secretary holds, properly, administrative powers equivalent to those of a Secretary of a department and is responsible for the good management of the Office of ASTEC.

Rationalisation of the Secretariat

7.30 We specifically considered the option of amalgamating the Office of ASTEC with the Office of the Chief Scientist. The staff of both organisations are part of the portfolio of the Prime Minister and Cabinet and work on somewhat similar types of policy issues. We are conscious of the small number of officers in the Australian Public Service skilled in science and technology policy analysis and of the value of developing a critical mass of expertise.

7.31 The Committee is, however, strongly of the view that ASTEC must have control over its own resources. Whether those funds are to be used to pay salaries, etc, for staff directly under ASTEC's control, or to buy in the required services, should be determined by ASTEC itself. The evidence suggests that economy and effectiveness gains should be able to be made by greater buying in of administrative services and professional advice with a gradual reduction in the size of the core ASTEC staff. The core staff should remain within the Office of ASTEC. At the same time, a more interactive working relationship between the Office of ASTEC and the Office of the Chief Scientist would be beneficial and steps need to be taken to achieve this.

7.32 In general, ASTEC is able to recruit high quality staff for its professional work. In the past, there has been a significant tendency for these staff to move on to other departments and agencies to fill senior posts - a situation which represents a benefit to the government.

7.33 We acknowledge the good work done by the staff over the years and emphasise that ASTEC's performance is critically dependent on the experience, qualifications and training of the people who work for it and the way their efforts are directed. This requires a good management culture with the following characteristics:

- competent top management and leadership;
- recruitment of appropriately qualified and highly motivated staff who are retained and given relevant training in policy advising;
- effective communication of objectives and priorities by the executive to all staff;
- up to date and cost effective information systems;
- an open and outward looking culture involving positive outside linkages; and
- integrity and the highest ethical standards.

To the extent that the Office of ASTEC does not meet all of these requirements, the Council's response to this Review provides an opportunity to establish an enhanced management culture.

Preparation of reports

7.34 We have noted above that ASTEC should produce a range of different types of report. The full responsibility for producing reports should not fall on the secretariat. Greater use could also be made of subcontracting and joint ventures to prepare draft sections of, or entire, reports. This could involve the research bureaux of government departments or other external sources of expertise such as the academies, institutions, private consultants or industry.

7.35 Reports should be more framed in terms of action to be taken rather than providing detailed background information on an issue. Their length would depend on the type of report but a focus on brevity would be beneficial. In most cases a draft report, or at least the findings and recommendations, should be circulated to interested parties for comment.

7.36 Once a report advocating policy change is presented to the Prime Minister and is tabled in Parliament, a process needs to be developed to ensure that the recommendations are examined and a government response is provided. A range of options is available to the government: placing the consideration of an ASTEC report on the agenda of the Structural Adjustment Committee of Cabinet; of full Cabinet; of PMSEC; of the PMSEC Ministers meeting as a committee; of CCST; or of a responsible Minister.

7.37 The Secretary, the Chairman and possibly the Deputy Chairman have a responsibility to draw the government's attention to the Council's reports and to ensure that they are referred on to departments. Progress should be monitored.

Working arrangements with the PMSEC

7.38 Consistent with ASTEC's role, there may be times when the Council can be used to prepare or contribute to PMSEC papers. The Prime Minister should determine whether other reports prepared by ASTEC should be presented to PMSEC if such action is timely. There could be merit in ASTEC's work program being presented at PMSEC as an information item. We believe that the distinctive roles of the two bodies need to be better explained to the community. We firmly believe that the two bodies should not be merged.

Resources

7.39 In its submission (page 37), ASTEC proposed four activities which would add to ASTEC's budget - "roughly \$250K for increased operational activity and \$200K to fill existing vacant staff positions; this would increase the annual budget from \$2.00M to \$2.45M ". The principal proposals were to:

- . establish government-university-industry roundtables to bring together these groups for structured discussions on S&T;
- . strengthen the Council's role as convenor of the meetings between State bodies and New Zealand counterparts;
- . increase the Council's international contacts and develop exchange schemes with like bodies overseas;
- . consult more widely during the preparation of the Council's work program and the performance of its roles.

7.40 The Review Committee is not convinced by ASTEC's arguments that these activities require additional funds. If ASTEC wishes to pursue these activities, then it should rearrange its priorities to allow for them from within existing resources. If necessary, the government can, as in the past, provide additional resources for specific studies requiring short deadlines or additional staff.

7.41 We would point out that it is difficult to achieve outcomes of lasting value from roundtables and that assiduous efforts by the Chairman to meet and maintain contacts with relevant individuals are likely to be more fruitful. Similarly, the Chairman and the Secretary should visit ASTEC-like bodies in the States to exchange views, thinking and progress on issues. The Council members, too, have a responsibility to establish and maintain networks in their fields and regions in order to raise ASTEC's profile in the community and assist in marketing its perceptions and judgements.

Validity of the findings

7.42 The Review Committee received over 90 written submissions. It interviewed personally 30 experienced individuals and commissioned consultants who interviewed a further 45 persons in relation to specific reports. In addition, it was provided by ASTEC with the results of a detailed survey of some of its stakeholders. Each of these sources of opinion was treated as a partial indicator but there was a strong consensus on major issues and views from each source tended to converge on a common position. One limitation was the need as a result of a limited budget for the Review to restrict the range of ASTEC reports which were studied in depth. The four that were selected covered diverse topics and provided insights into a range of activities. The Review Committee is satisfied that the procedures adopted in this evaluation have led to reliable and valid findings.

MANAGEMENT STRATEGY OF THE REVIEW

Review Committee arrangements, methodology and timetable

The Review Committee met in the ASTEC offices in late April 1992 and arranged for letters to be sent out to selected individuals and organisations here and in other countries seeking submissions. It also considered background papers concerning ASTEC's history, functions, management, organisation, perceptions of its performance, its products and the policy environment in which it has to operate. In June, it considered the submissions which had been received and appointed the consultants to undertake case studies selected by the Committee of the outcomes from four ASTEC reports. In July, the Committee met with the Council for the first time and started its schedule of interviews. The Committee met five times in August, to interview people in Canberra and Melbourne and to discuss issues with the Council and separately with the secretariat. It met four times in September to consider the consultants' report and to prepare the evaluation report. The report was provided to Mr Free in early October.

Resources used

ASTEC provided a Senior Officer Grade B to act as secretary to the Committee. He was initially involved on a part-time basis and from August onwards on a full-time basis. He called on some administrative support from the Office of ASTEC. ASTEC also provided sitting fees for the non-Commonwealth members of the Committee and met their travel and accommodation costs. Although the Committee selected the consultants, ASTEC provided a budget for this exercise.

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
1. Sir Gustav Nossal	Director, Walter and Elizabeth Hall Institute of Medical Research
2. Prof. Brian Anderson	Department of Systems Engineering, Research School of Physical Sciences and Engineering, Australian National University, and former member of ASTEC
3. Sir Geoffrey Badger	Former Chairman of ASTEC
4. Prof John Passmore	History of Ideas Unit, Research School of Social Sciences, Australian National University
5. P S Lang	Former Member of ASTEC
6. Mr Lloyd Zampatti	Bretts Pty Limited, and former Deputy Chairman of ASTEC
7. Dr Don Gibson	Chief Executive, SIROTECH
8. Sir Geoffrey Badger	Former Chairman of ASTEC
9. Mr Gordon Gregory	Senior Adviser, Office of the Minister for Trade and Overseas Development
10. Prof Peter Sheehan	President, Academy of the Social Sciences in Australia
11. Prof P L Arlett	Pro Vice-Chancellor (Research), James Cook University
12. Prof Phillip Lader	Vice-Chancellor and President, Bond University
13. Prof A R Hyland	Chair, National Committee for Astronomy, Academy of Science
14. Prof Don Aitkin	Vice-Chancellor, University of Canberra, and former member of ASTEC
15. Prof Brian Wilson	Vice-Chancellor, University of Queensland
16. Prof R W Parsons	Deputy Vice-Chancellor (Academic), University of Southern Queensland
17. Prof Lewis Branscomb	Centre for Science and International Affairs, Harvard University

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
18. Prof Roger Holmes	Deputy Vice-Chancellor (Research), Griffith University
19. Dr D J Faulkner	Immediate Past President, Astronomical Society of Australia
20. Prof Alek Samarin	Director of Research, Boral Research
21. Graham Mulroney	Dean, School of Applied Science and Technology, Phillip Institute of Technology
22. Prof Gavin Brown	Deputy Vice-Chancellor (Research), University of Adelaide
23. Prof Frank Larkins	Deputy Vice-Chancellor (Research), University of Melbourne
24. K G Neil	Secretary, Australian Industrial Research Group
25. Dr D J Gauntlet	Acting Director, Bureau of Meteorology
26. Prof C J D Fell	Deputy Vice-Chancellor, Research and Development, University of New South Wales
27. Prof D Leverett	Dean, Faculty of Science and Technology, University of Western Sydney, Nepean
28. Prof L W Nichol	Vice-Chancellor, Australian National University
29. Dr David Allan	Acting Director, Anglo Australian Observatory
30. Prof R O Slatyer	Chief Scientist, Department of the Prime Minister and Cabinet, and former Chairman of ASTEC
31. Dr D J Cook	Executive Director, Australian Nuclear Science and Technology Organisation
32. Prof R D Gibson	Vice-Chancellor, Queensland University of Technology
33. Prof P A Hamilton	Pro Vice-Chancellor (Research), University of Tasmania
34. Prof T F Smith	Deputy Vice-Chancellor (Research), La Trobe University

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
35. Prof Robert Porter	Deputy Vice-Chancellor, Monash University
36. Dr Meryl Williams	Executive Director, Bureau of Rural Resources, Department of Primary Industry and Energy
37. Prof P J Boyce	Vice-Chancellor, Murdoch University
38. Mr P J Slaughter	Executive General Manager - Corporate Development, MIM Holdings Ltd
39. Dr Wim Hutter	Director General, NWO (Netherlands Organisation for Scientific Research)
40. Prof P T Fink	Former Chief Defence Scientist
41. Mr Michael Osborne	Director, Science and Technology Policy Division, OECD
42. Mr G R Bentley	Acting First Assistant-Secretary, Economic and Trade Development Division, Department of Foreign Affairs and Trade
43. Prof K R McKinnon	Vice-Chancellor, University of Wollongong
44. Prof D Pugh	Dean, Research and Development, Royal Melbourne Institute of Technology
45. Prof L M Gillin	President, The Institution of Engineers, Australia
46. Dr Stella Clark	Honorary Secretary, Australian Society for Medical Research
47. Senator J N Button	Minister for Industry, Technology and Commerce
48. Dr R G Ward	Chief Defence Scientist, Defence Science and Technology Organisation
49. Prof D W Watts	Chairman, Northern Territory Employment and Training Authority, and former member of ASTEC
50. Dr B S Middleton	Executive Director, Australian Space Office, Department of Industry, Technology and Commerce, and former Secretary of ASTEC

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
51. Prof David Craig	President, Australian Academy of Science
52. Dr Paul Donaghue	Chief Scientist, ICI Research
53. Copy of submission 48	
54. Dr N S Willetts	Director of Research and Development, Biotech Australia Pty Limited
55. Dr G H L Rothschild	Director, Australian Centre for International Agricultural Research
56. Prof G A R Johnston	Vice President, Royal Australian Chemical Institute
57. Mr W Mansfield	Assistant Secretary, Australian Council of Trade Unions
58. Dr J W Stocker	Chief Executive, Commonwealth Scientific and Industrial Research Organization
59. The Hon Kim Beazley	Minister for Employment, Education and Training
60. Mr Neville Stevens	Secretary, Department of Industry, Technology and Commerce
61. H K Windle	Managing Director, Glaxo
62. Mr Lachlan McIntosh	Executive Director, Australian Mining Industry Council
63. Prof Stephen Hill	Director, Centre for Research Policy, University of Wollongong
64. Mr A S Blunn	Secretary, Department of the Arts, Sport, Environment and Territories
65. Prof Max Brennan	Chair, Australian Research Council, Department of Employment, Education and Training
66. Mr Andrew H Wilson	Consultant in Research Policy and Management, Ontario, Canada
67. Prof R J MacDonald	Pro Vice-Chancellors' (Research) Committee, Australian Vice-Chancellors' Committee

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
68. Ms Patricia Berman	Senior Adviser, Office of ASTEC
69. Prof R E Collins	Chairman, Energy Research and Development Corporation
70. Prof John Skinner	Dean of Research, Flinders University
71. Prof A W Thomas	President, Australian Institute of Physics
72. Dr Gregory Clark	Director, Science and Technology, IBM Australia Ltd, and member of ASTEC
73. Dr L A Brodribb	M. Brodribb Pty Limited, and former member of ASTEC
74. Mr J N Davenport	Former member of ASTEC
75. Prof R W R Rutland	Executive Director, Bureau of Mineral Resources, Department of Primary Industries and Energy, and former member of ASTEC
76. Prof Ian McCloskey	Chairman, Medical Research Committee, National Health and Medical Research Council
77. Mr H S Wragge	Director of Research, Australian Research and Overseas Telecommunications Corporation
78. Prof Paul Clark	Pro Vice-Chancellor (Research), Victoria University of Technology
79. Prof I J Polmear	Chairman, Australian Academy of Technological Science and Engineering
80. Mr F S Hambly	Executive Director, Australian Vice-Chancellors' Committee
81. Dr Angela Delves	Secretary, Federation of Australian Scientific and Technological Societies
82. Ms Di Zetlin	General Secretary, Federated Australian University Staff Association

ASTEC REVIEW - LIST OF SUBMISSIONS

NAME	POSITION / ORGANISATION
83. Mr G Glover	Superintendent Research Administration, BHP, Technology and Development
84. Mr E W Muir	General Manager, Corporate Relations Services, CRA
85. Prof John Clark	Deputy Vice-Chancellor (Research) Macquarie University
86. Mr Brian Fisher	Executive Director, Australian Bureau of Agricultural and Resource Economics
87.	ASTEC
88. Dr Jan Kolm	
89. Dr Martin Wardrop	Branch Director, Office of ASTEC
90. J F Stephens	CSIRO Staff Association

APPENDIX 2

IDENTIFICATION OF THE TERMS OF REFERENCE IN THE TEXT OF THE REPORT

Term of Reference 1 - Choice of missions and goals

Paragraphs 2.4, 5.2 to 5.4, 7.10 to 7.12

Term of Reference 2a - Effectiveness in identifying relevant issues

Paragraphs 5.6 to 5.11, 6.8, 7.12, 7.22, 7.23

Term of Reference 2b - Effectiveness in investigating and providing advice on S&T and related issues

Paragraphs 5.12 to 5.21, 7.6, 7.8, 7.9

Term of Reference 2c - Effectiveness of ASTEC's information and analysis in assisting the development of relevant Government policy

Paragraphs 6.1 to 6.26

Term of Reference 3 - The impact of ASTEC's outputs in terms of providing advice, or assisting policy development

Paragraphs 6.18 to 6.26

Term of Reference 4 - The adequacy and effective use of resources, structures and procedures

Paragraphs 3.1 to 3.7, 7.24 to 7.41

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